

**WHO**

**SYSCOM:** NAVAIR

**Sponsoring Program:** NAVAIR CTO - AI Transformational Thrust Areas

**Transition Target:** Maritime Surveillance Radars; Airborne RF ISR across the DoD

**TPOC:** (301) 342-3482

**Other Transition Opportunities:** The U.S. Department of Defense fields thousands of radar systems, airborne as well as sea and land-based radar systems, each of which may be vulnerable to cognitive electronic attack and thus represents the largest market for the Vadum-developed Electronic Warfare Advanced Capability Estimation (EW-ACE) algorithms.

**Notes:** Vadum is a software supplier with Northrop Grumman on multiple advanced development efforts relating to electromagnetic maneuver warfare (EMW).



<https://publicdomainvectors.org/en/free-clipart/Radar-vector-image/3333.html>

**WHAT**

**Operational Need and Improvement:** A variety of approaches are being employed as the basis for the underlying machine learning. These cognitive systems train continuously while operational in an unsupervised fashion in an effort to gain maximum insight to a dynamic threat environment. For example, concepts for true cognitive electronic warfare systems envision a neural network-driven sensor that “should be able enter into an environment not knowing anything about adversarial systems, understand them and even devise countermeasures rapidly”. As our adversaries field these systems, we will seek methods to counter them and in the same vein as we develop the very adaptive systems, we must understand their vulnerabilities and take steps to mitigate threats.

**Specifications Required:** We must better understand how to exploit these fundamental blind spots in the training algorithms and system capability which adversary might utilize and how to protect our own system from such deception. Consider undetectable adversarial training techniques as well as other approaches when designing a solution. Develop innovative and operationally efficient approaches to exploit weaknesses in an adversary’s neural network-based cognitive sensing systems, and by association, techniques to protect our own systems from deception.

**Technology Developed:** Vadum is developing the Electronic Warfare Advanced Capability Estimation (EW-ACE) suite of algorithms to provide electronic protection against cognitive jammer systems. The EW-ACE algorithms on Pulse Descriptor Words (PDWs) or similar high-level descriptions of received emissions and consist of association, characterization and inference algorithms. These algorithms are connected by a Jammer Behavior Object (JBO) which serves as a hierarchical data structure for storing information about both jammer observations (i.e., incoming PDWs) and inferences made during the execution of the algorithm. The JBO is a persistent data structure capturing a description of jammer behavior sufficient for EW-ACE to suggest electronic protection measures. After the execution of electronic protection measures, EW-ACE will monitor the response of the jammer and assess the effectiveness of the measures. The results of the assessment will be captured within the JBO for post-mission analysis and dissemination to other platforms.

**Warfighter Value:** Cognitive electronic protection systems will counter the increasing complexity and capability of jammer systems allowing cognitive sensors to prosecute their missions successfully in the presence of advanced electronic attack.

**WHEN**

**Contract Number:** N68335-21-C-0508      **Ending on:** Sep 15, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
First Capability Drop	Low	Basic Functionality	4	4th QTR FY22
Second Capability Drop	Medium	Improved Adversary Capability	5	2nd QTR FY23
Third Capability Drop	Medium	High Adversary Capability	6	4th QTR FY23

**HOW**

**Projected Business Model:** Vadum will serve as an cognitive electronic protection algorithm provider supporting integration, test, improvement, and sustainment of cognitive electronic protection algorithms to developers of radar systems which must operate in contested environments.

**Company Objectives:** Vadum's objective is to protect United States lives and assets by providing warfighters with the most capable cognitive electronic warfare solutions.

**Potential Commercial Applications:** Implement algorithmic approaches and concepts to defeat adversarial cognitive-based systems into Navy operation systems and concepts of operations. Incorporate methods to protect our own cognitive based sensors from exploitation. The same general techniques are applicable to a wide range of data-driven cognitive systems including commercial applications utilizing internet-based data mining.